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ABSTRACT

This report on India is one of a series of country case studies for a research project designed to identify training and education policies pursued by governments and manufacturing firms that have contributed to innovation, technological adaptation and skill development, and other structural changes in economy and work organization. Part 1 provides general information regarding India's economic situation and its training policies and programs in the three decades since independence in 1947. It looks at economic and social growth; human resources; educational levels of manpower; industrial development; government policies regarding training, technology, and computers; technical education and vocational training; and adequacy of vocational training. Other issues are industry and institutional feedback, financing of training, and training problems. Part 2 provides details of six case studies of manufacturing firms in India. It is based on data furnished by the firms in a questionnaire or obtained through personal discussions. Each study is divided into these areas: profile, technical changes/innovations, manpower profile and policies, training policies and practices, and skill diffusion. The questionnaire is appended. (YLB)

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TRAINING POLICIES

Discussion Paper No. 16

TRAINING IMPLICATIONS OF TECHNOLOGICAL CHANGE IN MANUFACTURING IN NEW INDUSTRIAL COUNTRIES: THE CASE OF INDIA

by

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Assisted by Institute of Applied Manpower Research,
New Delhi

Note: Discussion papers are preliminary material circulated to stimulate critical discussion and critical comment.

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PREFACE

This report on India is one of a series of country case studies carried out in 1984-1985 for the International Labour Office research project "Training implications of technological changes in manufacturing in new industrial countries (NICs)". The objective of the project is to identify those policies - in particular, training and education policies - - pursued by governments and individual manufacturing firms in selected new industrial countries which have contributed to innovation, technological adaptation and skill development and other structural changes in economy and work organisation. The ILO-commissioned study includes similar case studies in Brazil, Venezuela, Ireland, Yugoslavia and Hong Kong.

For the purpose of this project, the study in each country is focussed on the analysis of two major areas:

(1) the experiences of and policies pursued by a sample of manufacturing firms in each country, with particular reference to training and education-related policies, and

(2) The economic, social and Government policy environment in which the enterprises operate, with particular reference to education and training policies.

Methodology and Presentation

Ten manufacturing firms in India were selected to obtain information regarding employment, technological changes, research and development, training and skill diffusion. The main considerations in selecting the firms were diversity of functions, scale of operation, representation of both public and private sectors, and the likelihood of changes in technology and training procedures. All were near to New Delhi. The expertise of the Institute of Applied Manpower Research, which continually surveys manpower issues in India, was of great help in the selection of the firms.

Six of the ten firms responded to a lengthy questionnaire. They represent a good cross-section of the manufacturing industry in four Indian states and employ a total of about 41,000 people. Their activities include the manufacture of electronic components and systems; manufacture of tractors, diesel engines, machine tools and light commercial vehicles; fertilisers; manufacture of thermal power sets, motors, producer gas, acetylene, oxygen, nitrogen and compressed air; construction of power stations, generation and transmission of thermal and super-thermal power; and the manufacture of automobile shock absorbers, industrial equipment, motor cycles, tractors and some railway equipment.

The report is divided into two parts. Part One provides general information regarding India's economic situation and its training

policies and programmes. It covers the progress made during the three decades since Independence. Part Two provides details of six case studies. This is based on data furnished by the firms either in the questionnaire or obtained through personal discussions. The firms have not replied to all the questions and any generalisations based on the small selection of firms would be hazardous.

The study was entrusted by the ILO to Dr. Shyam B.L. Nigam as a consultant through the Institute of Applied Manpower Research of the Government of India. The Institute provided infrastructural and research support but is not responsible for the conclusions or findings of the consultant. The consultant thanks Shri M.P.Srivastava, joint chief of the Institute, who provided great help and research support, as well as Prof. Gautam Mathur, director of the Institute, and Dr. K.M. Khanijo, advisor in the Institute, and all those many Government officials and company executives who offered support.

TRAINING IMPLICATIONS OF TECHNOLOGICAL CHANGE IN MANUFACTURING IN NEW INDUSTRIAL COUNTRIES: THE INDIA CASE

PART 1

ECONOMIC AND SOCIAL GROWTH

India, at Independence in 1947, was a stagnant and backward country. Since then, India not only has come of age but thanks to successful implementation of a series of Five-Year Plans it has made substantial economic and social progress.

Recent social and economic statistics show that India's population has increased from 434 million people in 1960 to an estimated 761 million today, 24% of whom live in urban communities. India's total population is predicted to reach 972 million by the year 2000. Average life expectancy has risen from 42.5 years in 1960 to 54.6 years today while adult literacy has risen from 27.8% to 36.2% in the same period. The gross national product has gone up from US $60 per capita in 1960 to US $260 today.

In the period between 1900 and 1946, before Independence, India's national income rose only 1.2% per year, while agricultural and industrial production rose an average of only 0.3% and 2% respectively. By 1985, the annual growth rate for the national income was 5.2%, while agricultural production grew 4.3% a year and mining and manufacturing alone was growing 3.7% a year.

The Five-Year Plans which began in 1951 had four main objectives: growth, modernisation, self-reliance and social justice. In all of these, the achievements have been substantial while the incentives for achieving them have grown. Agricultural output has risen perceptibly and, with record food production, the country for the first time has begun to think in terms of exporting surplus wheat. Modernisation of the economy has been achieved through diversifying and introducing technological innovations.

Through a concerted policy of industrial growth, the share in the national income of mining, manufacturing, construction and other productive infrastructure increased from 14.9% in 1950-51 to 22.5% in 1978-79. In agriculture, cultivation methods were changed with the introduction of high-yielding crops, use of fertilisers, extension of irrigation and considerable research work.

Self-reliance in various sectors has increased considerably, living standards of the poorest groups of people have been improved and there has been a reduction of inequality in the distribution of incomes. Private consumption grew by 46% per capita between 1950-51 and 1978-79 while the poorest 30% of society increased expenditure on consumer goods from 13.1% to 15% in rural areas and from 13.2% to 13.6% in urban areas.

Improvements in economic growth are illustrated by these facts:

(1) The weight of engineering in the Index of Industrial Production grew from 8.3% in 1956 to 25.9% in 1970. Rubber, chemical and petroleum production increased from 11.7% to 18.2% in the same period in the same index while textiles declined from 47% to 21.5%.

(2) In agriculture, irrigated territory increased from 17.1% of all sown areas in 1950-51 to 28% in 1978-79; the use of fertilisers per hectare increased in the same period from 0.5 kilogramme to 29.5 kilogrammes; and the average yield of wheat per hectare increased from 6.6 quintel to 15.7 quintel.

(3) Imports constituted 25.2% of all iron and steel supplies in 1950-51. By 1977-78, it was necessary to import only 1.1%. Imported machinery dropped from 68.9% to 15.3% in the same period; food grain imports dropped from 5.9% to 0.2%; petroleum from 92.5% to 63.1% and nitrogenous fertilisers from 72.5% to 27.5%.

(4) The percentage of population below the poverty line declined from 48.3% in 1977-78 to 37.4% in 1983-84.

HUMAN RESOURCES

India's population was around 761 million people on March 1, 1986. Of these, 192 million or roughly one-fourth were living in urban communities. The population grew at a rate of 2.22% annually in the decade between 1961 and 1971 and at a rate of 2.25% between 1971 and 1981. Assuming that birth and death rates will decline from 33.2 and 12.2 per thousand in the period 1981-86 to 23.7 and 8.4 respectively in the period 1996-2001, it is estimated that the population in the year 2000 should be around 972 million. In 1980 nearly 40% of the population was below 15 years of age and 6% was above 60. The under-15 group is expected to drop to around 31.6% by the year 2000.

The labour force (15 to 59 years of age) was around 270 million in 1985, of whom 207 million were in rural areas and 63 million (roughly 24%) in urban areas. The labour force is expected to increase at an annual rate of 2.56% during 1985-90 and 2.24% during 1990-2000 as against an annual population growth of 1.96% and 1.69% respectively. It is expected to reach a total of 306 million by 1990.

Employment in the public and private sectors of industry in 1982-83 was as follows:

	Public Sector	Private Sector	
	(in thousands)		
Agriculture & Allied Activity	474	848	1322
Mining & Quarrying	884	120	1044
Manufacturing	1626	4637	6263
Construction	1119	68	1187
Public Utilities	720	38	758
Transport & Communications	2826	59	2885
Trade & Commerce	991	483	1474
Services	7782	1283	9065
Total	16420	7536	23956

The above figures show that manufacturing accounts for about 26% of total employment in the organised sector. However, manufacturing represents only 2.3% of the total labour force. Employment in the organised sectors doubled in the 20 years since 1960-61, with public sector employment jumping in the period from 58% to 68%.

EDUCATIONAL LEVELS

The total manpower in India with higher or secondary education in 1980 was estimated by Government planners to be 34,760,800, of whom 22,659,500 were economically active. University graduates and holders of diplomas (i.e. professionals and middle-level technicians) accounted for less than a quarter. The remainder had matriculated or passed through higher secondary schools. In 1985, it was predicted that the first group would remain about 25% of the estimated educated manpower force of 46,595,300. Of the total educated manpower who were unemployed in 1980, about 29% were graduates and diploma holders. The percentage was the same in 1985. The largest number of unemployed graduates were qualified in the arts.

Statistics released by the Indian Ministry of Labour for the years 1977 and 1978 give an indication of the pattern of occupations in various Indian manufacturing industries in both the private and public sectors. In the private sector, the number of professional, technical and related workers ranged from a low of 0.39% of the total workforce in the tobacco and tobacco product industries to a high of 10.98% in the pharmaceutical industry. Administrative, executive and managerial workers were only 0.22% of total workforce in cashew nut processing and ranged up to 3.94% in pharmaceuticals. In the public sector, professional, technical and related workers accounted for 27.6% of the total number of employees; administrative, executive and managerial workers were 2.3%; clerical and related workers 29%;

service workers were 12.3% and production and related workers, transport equipment operators and labourers accounted for 26.5%.

Of all professional, technical and related workers, more than 50% were employed in state government establishments, mainly because of the large number of teachers in these institutions. Nearly 50% of all administrative, executive and managerial workers were employed by quasi-governmental and central Government establishments. The largest number of production and related workers were in quasi-governmental establishments, with the next largest group in central Government.

In the manufacturing and mining sectors of Indian industry, more directors and managers with university degrees were working for the public sector than in private industry. Of the administrative and executive officials in Government and local bodies, nearly half were university graduates or post-graduates.

Ministry of Labour statistics indicate that, apart from the leakage of skill through emigration, there is considerable leakage or mis-use of technical skills among highly qualified categories of manpower. It was found, for example, that as many as 23% of engineers holding university degrees were working in non-engineering occupations in 1977-78. Another 6% were working as engineering technicians. In the case of engineering diploma holders, 35% were working in non-engineering jobs and 23.8% were holding positions as engineers.

INDUSTRIAL DEVELOPMENT

The impressive achievements in industrial development in India since the early 1950s go back to the Government's Industrial Policy announced in 1948. This was synthesised by the Industrial Policy Resolution of 1956 which has remained the sheet anchor of industrial development. Its essential objectives are: accelerated growth of output and employment; regional dispersal of growth; promotion of village industry; prevention of monopolies and concentration of economic power; the public sector to play a leading role within the framework of a mixed economy; and self-reliance through a policy-mix including protection of domestic industry from foreign competition.

During the three decades from 1951 to 1983 industrial production went up about six times. Industrial growth, however, fluctuated widely and the initial tempo was not maintained. During the first 14 years there was a steady annual growth rate of around 8%. It then climbed to a high of 9.5% in 1976-77 but slumped to 1.4% in 1979-80.

Some special features of India's industrial growth have been:

- Diversification of the industrial structure covering a wide range of consumer, intermediate and capital goods industries;
- Achievement of a large measure of self-sufficiency in developing indigenous capacities and equipment so that further expansion

in various sectors such as mining, irrigation, power, transport and communications can be achieved; self-reliance in basic and capital goods industries and capability to sustain future growth in these sectors;

- A steady decline in the number of manufactured goods imported;
- The appearance of industrial goods, particularly engineering goods, among exports;
- Development of technological and managerial skills capable of design, planning and construction of domestic industry and also of providing consultancy services for setting up industrial projects abroad;
- Considerable progress in industrial research and in absorbing, adapting and developing industrial technology.

The public sector has played a predominant role in developing basic industries, such as steel, non-ferrous metals, petroleum, coal, power, railways, fertilisers, heavy engineering and consumer industries including textiles, drugs and pharmaceuticals, cement and sugar. At the same time, the private sector has been encouraged through a variety of fiscal and other measures including the setting up of about 50 specialised development banking institutions which have helped finance the development of this sector.

Despite its impressive achievements, the industrial scene suffers from constraints and difficulties. There has been the chronic problem of inadequate and irregular power supplies hampering production. Inadequate attention has been paid to the problems of reducing costs, improving quality and raising productivity. There has been a widening technology gap between India and the rest of the world, resulting in obsolescence of equipment and production techniques. Inadequate supplies of raw materials and insufficient demand have hampered production in some industries, such as textiles, jute manufacture and steel. Plant capacity utilisation in 1983 ranged from 54% in basic industries to 77% in consumer goods.

To give an incentive to industrial development during the 1980-1985 Five-Year Plan, the Government lifted a large number of restrictions relating to licensing and investment in a variety of industries. The relaxation of licensing gave manufacturers more opportunity to achieve a mix of products in keeping up with market demands. Investment subsidies and tax concessions were extended. So-called "no industry districts" were given priority in licensing and development; manufacture of computers and electronic equipment was encouraged by new liberalised measures and telecommunications equipment, previously a monopoly of the public sector, was opened to private manufacture.

This was followed by plans for the Seventh Five-Year Plan (1985-1990) which lay down new objectives for the industrial sector:

(1) Ensure an adequate supply of mass consumption goods at reasonable prices and of acceptable quality;

(2) Maximise utilisation of existing facilities by restructuring them, improving productivity and upgrading technology;
(3) Concentrate on the development of industries with large domestic and export potential and emerge as world leaders in these fields;
(4) Usher in "sunrise" industries with high growth potential and relevance to India's needs;
(5) Evolve an integrated policy toward self-reliance in strategic fields and open up avenues for employment of skilled and trained manpower.

The plan called for greater emphasis to be placed on production of petro-chemicals and electronic components and materials, rather than on the steel-based industries which marked the first phase of India's industrialisation.

GOVERNMENT TRAINING POLICY

Although technical education was available in India before Independence -- the Universities of Calcutta, Bombay and Madras were established in 1857 -- real expansion occurred with the early Five-Year Plans. In 1951 there were 142 institutions for higher technical education. By 1982-83 that number had soared to 715.

Vocational training before Independence was limited to the railways, to ordnance factories and a few private firms. Some industrial schools had been set up by state governments and in the Second World War centres were established for technical jobs in the armed forces. After 1951 vocational training programmes along with the necessary facilities were speeded up after the establishment of a Training and Employment Service Organisation Committee in 1952 and a National Council for Training in Vocational Trades in 1956.

By the time of the Sixth Five-Year Plan (1980-1985), however, it was recognised that there was still a need for improvement despite a phenomenal increase in facilities for technical education. The Planning Commission called for consolidation and maximum use of facilities; improvement in the quality of education at all levels; and "identification of critical areas and creation of necessary facilities for education in emerging technologies in the light of proper assessment of future technological manpower requirements." It emphasised the need for facilities for training in "areas like computer science, product development, maintenance engineering instrumentation and bio-sciences. Centres would also be set up for advance studies and research in selected institutions in emerging technologies like bio-conversion, laser technology, micro processor development and application, fibre optics and optical communication, remote sensing technologies, energy systems, reliability engineering and atmospheric sciences."

Other proposals of the Sixth Plan were for carrying out engineering projects on college campuses; development of closer relations between

established institutions and new ones; strengthening linkages between industry and education, and fuller use of the facilities in technical institutions.

The Sixth Plan also recommended that ITI training should be revamped to make it more "self-employment and production oriented" with courses having potential for self-employment. Regular ITI training programmes, it suggested, should be extended to include project formulation and courses on management, accounting and marketing. Furthermore, training courses were to be established for rural youth to give them incentives to set up their own ventures.

The plan noted shortcomings in existing schemes for training apprentices, such as deficiencies in their training and "non-absorption of trained apprentices in regular jobs." It suggested measures which included accommodation, higher pay, better supervision and liaison with industry and it urged industry to reserve a percentage of jobs for newly trained apprentices.

The actual achievements of the Sixth Plan at national level are considered to have been significant. There was an overall increase in the rate of growth, food production went up, and there were special schemes to help poor sections of society. The rate of inflation and the balance of payments were kept under control. But at the local level, there were evidently deficiencies in the plan. The observations and recommendations of the Seventh Plan (1985-1990) made this clear in regard to the area of technical training. The recommendations of the previous plan were repeated, stressing the need for better training and research facilities, for modern laboratories and workshops from engineering colleges to ITIs, and upgrading of curricula to meet the demands of new technology.

At the vocational training level, the new plan reiterated the same problems as previously: poor teaching, obsolete equipment and machinery, the need for more co-ordination of training plans with industry and for more funds.

As far as training in rural areas is concerned, there are many arrangements for assisting the development of small industry. Besides Prototype Development Centres, various all-India industrial boards offer training programmes in rural areas for entrepreneurs, craftsmen, artisans and supervisory staff. The Sixth Plan provided arrangements to assist trainees with tools and equipment, credit and marketing assistance. The Seventh Plan hopes to take steps to allow small-time entrepreneurs to experiment with new technology and see its value. "As introduction of new technologies involve risks, a scheme for providing risk insurance cover on venture capital will be examined," the plan promised. It also called for setting up demonstration centres in rural areas, rural technology institutions, mobile units to demonstrate new processes to artisans and expanded programmes for training personnel for rural industry.

GOVERNMENT TECHNOLOGY POLICY

India's various Five-Year Plans have repeatedly emphasised the need for rapid development of science and technology, an increase in the number of qualified manpower and innovations in industry. The Sixth Five-Year Plan made suggestions for expanding scientific education and basic research, and introducing new technology to agriculture and industry, telecommunications, health, housing, transport and other sectors. Investments for science and technology was substantially higher than in earlier plans. New Government departments were established such as those for environment, ocean development and non-conventional sources of energy. A Cabinet Committee on Science and Technology and a Science Advisory Committee to the cabinet were set up in 1981. A National Biotechnology Board was created in 1982. A National Science and Technology Entrepreneurship Development Board also came into being in 1982 to "prepare a basket of employment opportunities, including self-employment, to arrange for training of science and technology personnel in entrepreneurial matters and to channel institutional finance for promoting self-employment among scientific and technological personnel."

Furthermore, a National Council for Science and Technology Communication was also set up in 1982 to popularise science, and other measures were taken to provide more incentives for scientists. In January 1983, a Technology Policy Statement outlined Government aims as being to:

- Attain technological competence and self-reliance, to reduce vulnerability, particularly in strategic and critical areas, making maximum use of indigenous resources;
- Provide maximum employment to all strata of society, with emphasis on the employment of women;
- Use traditional skills and capabilities, making them commercially competitive;
- Ensure the correct mix between mass production technology and production by the masses;
- Ensure maximum development with minimum capital outlay;
- Identify obsolescence of technology in use and arrange for modernisation of equipment and technology;
- Develop technologies which are internationally competitive, particularly those with export potential;
- Improve production speedily through greater efficiency and fuller utilisation of existing capabilities and enhance the quality and reliability of performance and output;
- Reduce demands on energy, particularly preserve the ecological balance and improve the quality of the habitat; and
- Recycle waste material and make full use of by-products.

The same statement stressed the need for education and training in the sciences and technology. It said that special attention would be

given to new areas such as the information and materials sciences, electronics and bio-technology. Basic research and building "centres of excellence" would be encouraged. Skills and skilled workers would be accorded special recognition. The quality and efficiency of technology generation and delivery systems would be continuously monitored and upgraded. The Policy Statement said that a central organisation would be established to undertake forecasts of future technological needs and and draw up research programmes and that urgent attention would be paid to keeping track of international technological developments.

Even greater attention -- the largest amount ever -- was given to science and technology in the current Five-Year Plan. The plan stressed the need for consolidating all efforts made so far saying that "as a first step, it would be necessary to consolidate and modernise the infrastructure in all the areas of relevance for the future, in terms of both physical facilities and human resources. It would be necessary to establish linkages between the different sectors of education, scientific research, technology development, productive activities in agriculture, industry, etc and Government decision making structure." It called for mechanisms to attract some of the country's best brains to science and create a leadership which was vital for scientific growth.

GOVERNMENT COMPUTER POLICY

The need to take steps to end India's decade-long delay in the adoption of new electronic and computer technologies was recognised in the Sixth Five-Year Plan (1980-85). A Department of Electronics was set up by the Government and a commission was appointed to define areas in the computer sciences and technology which required programmes to develop trained manpower. The panel recommended the initiation of teacher training programmes. A working group found that, despite the existence of 22 centres providing courses in computer sciences and qualifying 1,500 people at various levels in 1984-85, there was then a yearly personnel shortage of about 600. The centres, it was estimated, would produce about 2,600 such personnel in 1989-90 but by that time there would still be a shortage of about 3,000 people a year.

A package of measures was announced to encourage computer technology. These included the slashing of excise duties on many electronic products, reduction of tariffs on key imported components and freer access to technology. In November 1984 and August 1985, new fiscal, administrative and licensing measures were introduced. These were designed to encourage local computer manufacture, simplify procedures for computer users to meet their needs either locally or from overseas sources, and to promote appropriate applications for computers. The Department of Electronics announced plans to set up research, design and development facilities, including an agency to develop software for export and local use.

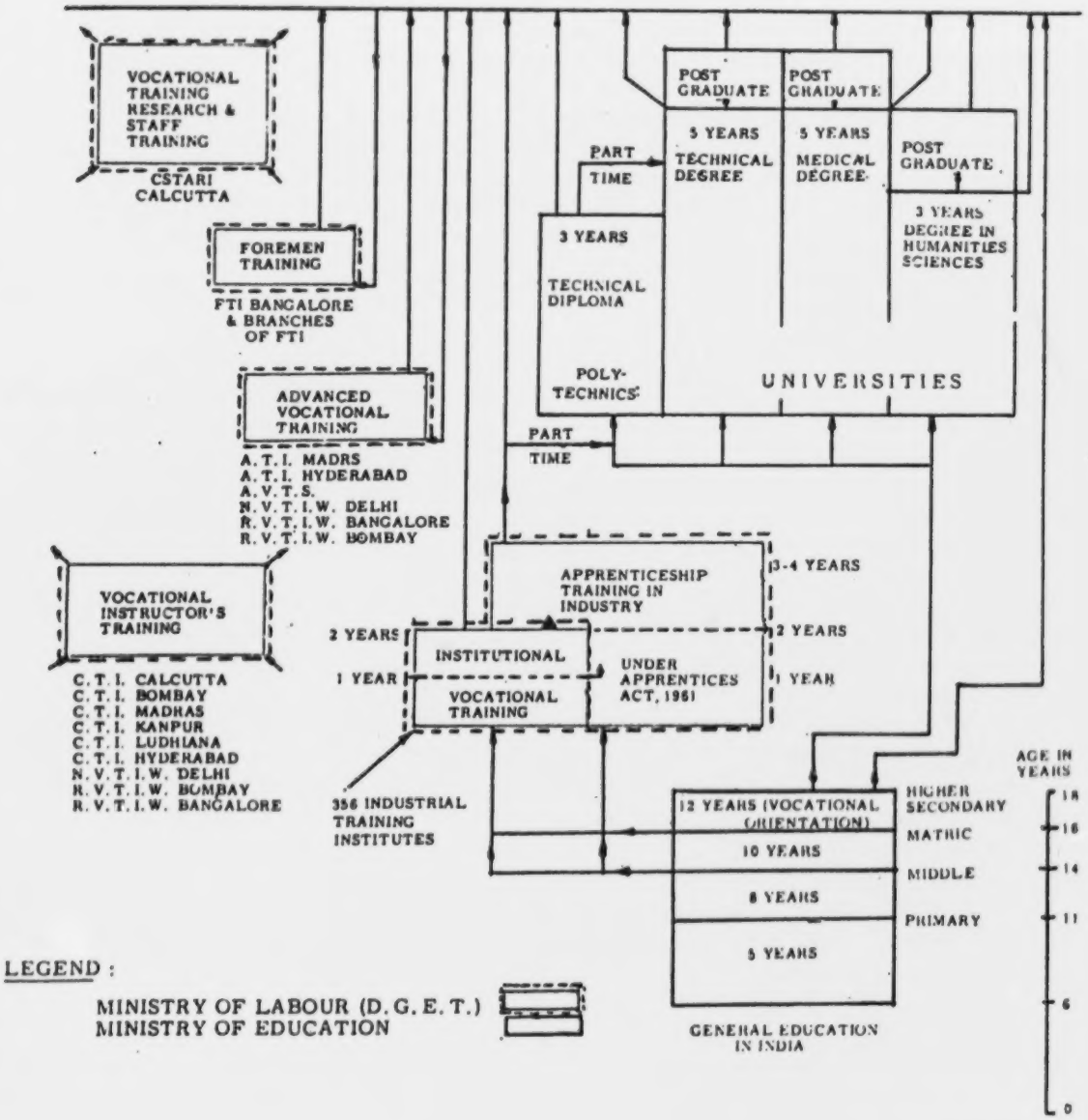
TECHNICAL EDUCATION AND VOCATIONAL TRAINING

Every Five-Year Plan since Independence has stressed educational and training programmes to develop the trained manpower needed for accelerated economic development. Allocations for education and training are second only to defence in the Indian budget.

The number of educational institutions of all types increased from 230,000 in 1950 to 690,000 in 1983 with an enrolment of 114 million. Secondary and higher schools increased from 7,300 to 52,279. In 1984-85 there were 5,246 pre-degree colleges for general education, and 140 universities. There were 130 specialised research laboratories and institutes set up under the aegis of various Government authorities, along with 600 research and development laboratories as public and private sector undertakings. In 1980 about 150,000 qualified scientific and technical personnel were being trained every year. The total qualified manpower was estimated at 2.5 million.

Technical education and training, including vocational training, is basically the responsibility of the Ministry of Education (recently renamed the Ministry of Human Resources Development) and the Ministry of Labour and Rehabilitation. The former is responsible for providing professional and middle-level technical manpower and the latter for skilled workers (craftsmen). In addition, there are in-house training organisations, agencies, on-the-job training systems, private training schools, etc,. Training under sectoral programmes and schemes is also carried out by various Ministries, Departments and Boards such as Health, Education, Rural Development, Irrigation, Power, Housing, Science and Technology, etc. The diagram on the following page illustrates the technical education and training arrangements under the Ministries of Education and Labour.

VOCATIONAL AND GENERAL EDUCATION IN INDIA



The technical education and vocational training of professionals, technicians and skilled workers is as follows:

Professionals and technicians

In 1985, a Government working group made public its estimates of skill shortages and identified areas where critical requirements would arise in the next five to 10 years. It suggested short- and long-term measures to deal with the situation. The working group estimated there would be a need for between 81,100 and 105,300 more engineering graduates and between 114,100 and 147,600 more engineering diploma graduates in the period 1985-90. It estimated that existing institutions would turn out 107,300 engineering degree holders and 178,000 engineering diploma holders - an adequate number to meet needs during the period. The working group said however that various factors could distort these figures and there was a need to watch them.

During the last 10 years, technical education has been widely diversified to include new technology. New subjects like these now appear on curricula: production engineering, instrumentation engineering, energy engineering, computer science and technology, systems engineering and management, mineral resource development, water resource development, robotics, fluidics, cryogenic engineering, ocean engineering, man-made fibres, renewable sources of energy and its utilisation.

While the overall engineering situation is not regarded as a matter of concern, serious imbalances have been experienced in specialised categories of engineering manpower. At one stage, the flood of newly trained technical personnel resulted in 23,000 engineering graduates and 119,000 diploma holders being on the live register of employment exchanges. The working group on Identification of Technical Manpower Shortages in 1984 reported that shortages existed or would soon appear in environment engineering, bio-engineering, micro-electronics, satellite communications, non-conventional energy source development, computer systems, nuclear science and technology, TV service and electro-medical equipment, fire and marine engineering, naval architecture, instrumentation and machine development, bio-technology, materials research, optical fibres, etc.

The electronics industry is targeted to grow 38% annually during 1985-1990. A Government study team estimated that there will be a serious shortage of 115,200 graduates, diploma and certificate holders in this field by 1989-90 if the economy reaches its planned annual rate of growth of 35.5% by that date. A National Workshop on Electronics suggested steps to meet the shortages including strengthening universities and other institutions, expanding on-the-job training and

setting up a centre to study the reorganisation of education at all levels.

Skilled Workers/Craftsmen

Extensive training facilities to produce semi-skilled, skilled and highly skilled craftsmen, craft instructors, supervisors and training executives have been established by both central and state governments, overseen or administered by the Ministry of Labour and Rehabilitation. They include schemes for craftsmen training, apprenticeship training, craft instructors' training, foremen training, vocational training programmes in women's occupations, executive training programmes and vocational training research, special training programmes and parttime training classes.

Besides the Government schemes there are many private training institutions all over India, as well as on-the-job and pre-service training arrangements in public and private sectors. Unfortunately, a complete catalogue of these is not available.

The extent of Government-run programmes is outlined in the following table:

Executive Training:	Central Staff Training and Research Institute (CSTARI), Calcutta* .
Foremen Training:	Foremen Training Institutes (FTI), Bangalore, Jamshedpur.
Advanced Skill Training:	Advanced Training Institutes (ATI), Bombay, Calcutta, Kanpur, Madras, Ludhiana & Hyderabad.
	Advanced Training Institutes for Electronics & Process Instrumentation, (ATIEPI), Hyderabad & Dehradun.
	National Vocational Training Institute for Women (NVTI)** , New Delhi.
	Regional Vocational Training Institutes for Women(RVTI)**, Bombay, Bangalore, Trivandrum.
	Advanced Vocational Training System (AVTS), 16 Industrial Training Institutes of state governments.
Craft Instructors Training:	ATIs, Bombay, Calcutta, Kanpur, Ludhiana and Hyderabad.
Apprenticeship Training:	138 Trades Designated (3 subsequently omitted), 217 specified industries.

* This institute also conducts R & D in vocational training.

** These institutes are exclusively for women. Certain basic level instructors' courses are also held here.

Craftsmen Training:	1161 Industrial Training Institutes and Centres, 58 Trades
Restructured Craftsmen Training:	4 model Industrial Training Institutes at Haldwani, Calicut, Choudwar, Jodghpur.

Some features of the Government's programmes are as follows:

(i) Craftsmen Training Scheme:

Training of one to two years (mainly one year for non-engineering trades and two years for engineering trades) is provided under the Craftsmen Training Scheme in 32 engineering and 26 non-engineering vocations to school leavers of 15 to 25 years of age. Admission requirements vary from two classes below matriculation to pass in matriculation or equivalent, plus an aptitude test. In 1984 there were 1,161 Industrial Training Institutes (ITIs) or Centres -- 661 of them Government controlled and 500 privately run. Nearly 1.4 million craftsmen so far have been trained under this programme. In the last five years, there has been a spurt in the number of ITIs. The number of places in Government centres has increased 60% with a 35% increase in private institutions. Training is free. Workshop clothing, sports, medical and hostel facilities are provided and a third of the trainees receive stipends. Skill competitions are held in a number of trades. An All-India Trade Test is held at the end of training and successful candidates are awarded a National Trade Certificate.

(ii) Apprenticeship Training Scheme

To regulate training of apprentices in industry, an Apprenticeship Act passed by the Government came into force in 1963. Under this act, employers in 217 industries are obliged to engage apprentices according to a prescribed ratio and give them specified basic training followed by on-the-job shop floor training. Minimum stipends for each trade are prescribed. Entrance qualifications vary from a pass in 5th Class to Higher Secondary, depending on the trade. Under the act, 135 trades are designated for training which ranges from six months to four years. At the end of training, tests are carried out by the National Council for Training in Vocational Trades and successful candidates receive a National Certificate. In 1984 more than 12,000 industrial enterprises with 125,000 apprenticeship training places in 135 trades were covered under the act. In 1973, degree and diploma apprenticeships were also brought under the act and their training now involves about 13,000 persons in nearly 60 fields of engineering and technology. About 30 to 40% of apprentices are in private sector establishments.

The cost of training apprentices is borne by employers. However, in the case of establishments employing less than 500 workers 50% of the training costs, including the stipends, of trade apprentices is

reimbursed by the Government. The Government pays 50% of the stipends of all graduate and diploma apprentices.

(iii) Craft Instructors Training Scheme

A Central Training Institute at Madras and six Advanced Training Institutes in other cities train instructors for the ITIs and the Apprenticeship Training Programme. Refresher courses and retraining of instructors whose courses have become obsolete also are held at these institutes. Facilities for training instructors in diversified fields -- both in methodology and skill updating -- also exist at these centres.

(iv) Foremen Training Scheme

Two Foremen Training Institutes at Bangalore and Jamshedpur organise training programmes for existing and potential shop foremen and supervisors in technical and managerial skills. The training is given in various trades such as maintenance mechanics, applied mechanics, electrical controls, hydraulic and pneumatic controls, engineering material and heat treatment, technical drawing, metrology, production engineering, industrial engineering, technical report writing, personnel management, design of jigs and fixtures and workshop practice. Theoretical instruction is supported by necessary laboratory work and shop floor demonstrations, as well as practical shop work for upgrading skills. Trainees are taken to important local industries. The centres have sophisticated equipment in their workshops and laboratories.

(v) Women's Training Programme

A National Vocational Training Institute for Women and three Regional Training Institutes for Women provide facilities for training in basic and advanced skills in trades which have high employment potential for women. These include dressmaking, embroidery, secretarial practice, electronics, TV servicing, instrument repair, etc. Training courses also are held for instructors.

(vi) Advanced Level Training Programmes

The following advanced level training programmes are in operation:

(a) The Advanced Training Institute at Madras conducts fulltime courses of two to 16 weeks to upgrade and update the skills of industrial workers and technicians in 14 trades.
(b) Two Advanced Training Institutes for Electronics and Process Instrumentation set up by the Government train personnel as craftsmen and technicians in industrial and domestic electronics and process instrumentation. They offer training for craft instructors in selected fields and refresher and upgrading courses.

(c) An advanced vocational training system was launched in 1977 to provide several sophisticated skills not available under the craftsmen and apprenticeship training programmes. Since then, 16 ITIs have been modernised for this purpose and another 75 will be updated in the second phase of the programme.

(d) Two institutes with sophisticated machinery and equipment in eight workshops and five laboratories for different trades have been set up to train existing and potential shop foremen and supervisors in technical and managerial skills.

(e) A Government programme exists for training executives and for conducting vocational training research. It has a wing which holds seminars and workshops for executives involved in the training departments of industry, ITIs and other training institutes. A research wing conducts studies to bring about improvement in various aspects of vocational training -- e.g. curriculum development, training methods and material development, qualitative skill analysis, advisory services to industries and training institutes. A development wing develops and produces training materials and aids. All these activities are carried out in the Central Staff Training & Research Institute at Calcutta which was set up for this purpose.

(vii) Special Training Programmes

New programmes introduced to ITIs include those to make training more production-oriented and to assist trainees more toward self-employment. There is a "earn while you learn" scheme in 12 state and union territories; there are modules for entrepreneurship and self-employment training in the syllabuses for craftsmen training and apprenticeship schemes; and there is a National Entrepreneurship Training Scheme. This is to prepare craftsmen and apprentices for self-employment by providing training in such trades as scooter and motorcycle service mechanic, auto electrician, general electrician, TV and radio service mechanic, garment manufacturing, and retreading of tyres. Besides the Ministry of Labour, other agencies are conducting entrepreneurship development training programmes, viz. the National Entrepreneurship Board under the Department of Science and Technology (for scientists and engineers), and the Development Commission for Small-Scale Industries (for engineering graduates and diploma holders as well as non-engineers and women).

(viii) Parttime Training Classes

Under the Craftsmen Training Scheme, parttime classes are arranged during mornings and evenings in the ITIs for workers without the benefit of regular institutional training. These cover trade theory, workshop calculations and science and engineering drawing courses pertaining to the respective trades of the trainees. A fee of 2 rupees a month is charged and the training lasts two years.

ADEQUACY OF VOCATIONAL TRAINING

Unlike the efforts made to assess likely future needs among professional and technician groups of manpower, no attempt has been made to determine whether vocational training facilities for skilled workers are sufficient for the present and future. There have been demands that such an assessment should be made on a scientific and continuing basis, but there are immense difficulties in carrying this out on an all-India basis. A working group set up by the Ministry of Labour in 1984 in connection with preparations for the Seventh Five-Year Plan concluded that skilled manpower planning cells should be set up at central and state headquarters. The group observed that"with the rapidly increasing vocational training activities all over the country, it is desirable to plan future expansion as per requirements of skilled manpower in various categories/levels for the industry. The proposed cells should be adequately staffed and provided with necessary budgetary support for collecting and compiling data of various types, conducting area surveys, maintaining linkages with different types of agencies dealing with industrial growth and maintaining liaison with various agencies engaged in the vocational training field."

It is difficult to say with any conviction that present training arrangements are adequate to meet immediate and future needs of the economy. The report of the Planning Commission's Working Group on Technical Manpower Shortage in 1985 gives some indications of the situation, although it related more to technicians than to skilled workers when it stated:

"Except in industrially backward areas, there would appear to be no need to set up new polytechnics. Post-diploma training programmes may be conducted by concerned industries in specialised fields like hydraulic and pneumatic controls, computer programming, non-conventional energy source development, computer software, TV service, electro-medical equipment (maintenance and servicing), numerically controlled machines and computer numerically controlled machines with a view to improving employability and render the trained manpower more useful to the industry."

At the moment, ad hoc adjustments to the number of vocational training facilities are made on the basis of signals from the labour market. Local advisory committees attached to each Industrial Training Institute give principals advice on improving training programmes. Similar committees advise central and state governments. But it is doubtful that they can provide meaningful indications about the future needs of industry and the economy. The Central Ministry of Labour, however, conducts periodic surveys to determine the supply of and demand for skilled manpower in particular industries or areas.

Data from employment exchanges reveals imbalances in the supply of and demand for craftsmen. In 1977, a Government committee of experts reported that 21% of ITI-trained persons were unemployed. Since then the situation may have worsened. On the other hand, in the machine tool industry the Ministry of Labour reported shortages of turners, fitters, welders, moulders, grinders, plumbers, machinists, jig borers, millers, millwright heavy lathe operators, tool and die makers, die fitters, and cylindrical grinders. Such imbalances seem to be caused by the poor quality of education and training at some ITIs where tools and training materials have been reported lacking, along with inadequately qualified instructors. In 1978 a Government committee made suggestions for remedying such gaps but many of its recommendations remain unimplemented.

A Ministry of Labour vocational training study group said in 1984 that "so far there has been no concerted attempt to review and consolidate various training schemes being conducted under the aegis of the Directorate General of Employment and Training". It recommended that training programmes should be designed so that a worker "could rise from the lowest rung to the highest level in the supervisory cadre by acquiring requisite skills and knowledge both through institutional training and on-the-job training. "There should be complete dovetailing of training both in the institutions and on-the-job so that a national pattern of trade testing, certification and recognition of qualifications at various levels is established," it said.

INDUSTRY AND INSTITUTIONAL FEEDBACK

In principle, procedures exist for feedback from industry to vocational training institutions at all levels, and vice-versa. The local advisory committee attached to each ITI advises the principal on improvement of training arrangements. Similarly, advisory committees at the state level provide guidance to the state director of training on training policies and arrangements. Representatives of both employers and workers are members of these advisory bodies. Although the needs of industry and the market do affect -- sooner or later -- the vocational training policy of the Government, there is no doubt that there remains much scope for improvement.

In the case of apprenticeship programmes there is close liaison with Government and industry at all levels - in placement of trainees in industrial establishments, in payment of stipends and sharing of cost, and in the examination of trainees. About 30 to 40% of apprentices are in private sector establishments.

In the case of polytechnics and engineering colleges and universities, which produce middle-level technicians and professionals, the collaboration of industry is not as close. Industry, however, is represented one way or another in workshops and seminars organised by the Government to consider likely future needs. Industry experts

also are represented on curriculum and course committees of some polytechnics and engineering colleges. In 1983 a national seminar organised by the Department of Science and Technology included representatives of public and private sector enterprises. The seminar was to obtain better appreciation of the thrust areas for research and it discussed the problems in such areas as chemical engineering, civil engineering, computer applications, electronics and communications, energy, mining engineering electricity and power, shipping and transport, etc. Industry, research institutes and subject specialists were involved in the recommendations for research and current and future policy.

Despite current collaboration between industry and training institutes, the Planning Commission's Working Group on Identification of Technical Manpower Shortage urged: "To facilitate productivity improvements, it will be useful to maintain a close co-ordination between educational/training institutions and industrial establishments so that the former can keep pace with the needs of the latter. Industries may be encouraged to sponsor candidates to undergo ITI training in cases where it is feasible. In this context, teaching programmes may be arranged on an exchange basis in which the faculty in educational/training institutions and the production managers of key industrial establishments can participate. In-house training facilities in major industrial establishments may be organised for training newly recruited personnel as well as for the retraining of those already employed with a view to equipping them adequately to meet the challenges of their jobs and contribute toward productivity improvements."

FINANCING OF TRAINING

Virtually all technical education and training to produce professionals and middle-level technicians is financed wholly by the Government. All private engineering colleges and polytechnic-type institutions which are recognised by the Government receive grants-in-aid. Unrecognised colleges, whose number is not large, are self-financing. The Seventh Five-Year Plan suggested, without giving details, that budgets for technical education will have to be supplemented by contributions from user industries and organisations. This is expected to occur when closer collaboration with them is established.

Fiscal concessions in the form of liberal depreciation allowances and income tax exemptions are offered by the Government to private and public sector enterprises which provide approved in-house training. In 1980, more than 600 such in-house arrangements were approved.

Government-run Industrial Training Institutes for skilled workers -- which account for about 60% of all such institutes -- are fully financed by the Government. Private ITIs do not receive Government grants.

The cost of the Apprenticeship Training Scheme for trade apprentices is shared equally between the Government and enterprises employing less than 500 people. Employers with more than 500 workers bear the entire cost of training. The central Government pays 50% of the stipends of graduate and diploma apprentices. All apprentices are paid between 230 and 450 rupees a month.

Besides private ITIs, there are other private training institutes in various fields, such as computer software. These are not controlled by the Government and are self-financing, some of them charging high fees.

TRAINING PROBLEMS

Notwithstanding the progress made in the number and variety of technical institutions, imbalances in the demand for and supply of technical manpower continue to exist and have been highlighted in Government documents. The major shortcomings were summed up by the Sixth Five-Year Plan (1980-1985) in this manner:

"The fact is that the science and technology content of Indian society as it is today (as borne out by the total national investment in this sector, the number of technically qualified personnel, the facilities for science and technology education, the size of technical services, etc), as well as its involvement in research and development, is low in comparison to the size and population of the country. A large part of the total stock of science and technology manpower is not actually engaged in activities that can be construed as scientific or technical. Even more significantly, the quality of these personnel varies widely; there will be need for a considerable reorientation and upgrading of a large proportion of this stock of manpower through appropriate training programmes.

"In large areas of economic activity, relatively obsolete and cost-ineffective technology continues to be applied, the pace of scientific and technological innovation remains unimpressive and the adoption of the available scientific and technological knowledge is tardy. There are many gaps in new important fields and in the ranks of leadership and in excellence. While in the early years after Independence there was a rapid expansion in university education, an increase in the number and size of facilities and in the formation of new institutions, all of which created a new plan, few new institutions have been started recently. In universities and several other institutions the support provided has not kept pace with the increased need for better facilities. In a large number of areas, our capabilities are almost 20 years behind those in the advanced nations and also behind those established recently in some developing countries.

"The competitive capability, in international terms, of our scientific community has been impaired and this has prejudiced the provision of experience of modern science backed up by modern technology and

instrumentation to the large majority of graduate and postgraduate students, thereby affecting their level of appreciation of new science and their capabilities for research. There is a lack of co-ordination between manpower requirements (in terms of areas and levels of training and numbers) and the actual training of personnel which has led to serious shortage of manpower in many areas.

"In sum, while significant advances have taken place on the science and technology front in India over the past three decades, the gap between what obtains in this country and in other advanced countries in terms of infrastructure and capabilities has significantly widened due to the much faster rate of progress in those countries. There is, therefore, no room for complacency based on our past accomplishments."

The above shortcomings were reiterated by the Seventh Five-Year Plan (1985-1990). The Plan stated that "there are enormous differences between infrastructural facilities and capabilities that are available in specialised scientific agencies and national laboratories, in the industrial undertakings and in the educational system. The latter, in particular, has been allowed to run down to an unbelievable extent ... The coupling between the science and technology infrastructure and capabilities and the production system in the country is weak."

The inadequacy of linkage with and feedback from industry to technical institutions and vice-versa has been mentioned by various committees and Plans. They state that advisory bodies attached to ITIs, for example, are not fully used nor are their recommendations given the attention they deserve in shaping the content of training courses. The result is a lack of relevance between actual training and actual requirements, resulting in unemployment of trained personnel.

Committee reports state that obsolete equipment in some training institutions, with the absence of equipment in others, leads to poorly-trained personnel. A lack of funds at State level to improve training in State-run ITIs, as well as an absence of inspection of some of these, makes the situation worse. Furthermore, the vocational training programmes lack, on the whole, adequate flexibility, coherence, efficiency and orientation to production. There is little flexibility for accommodating new occupations and skills. Tests and certificates leave much to be desired.

Another lacuna, repeated in report after report, is the lack of mechanisms in industry and state and central governments for a continuing assessment of manpower requirements. The Seventh Five-Year Plan supported the suggestion of the Planning Commission's Working Group on Identification of Technical Manpower Shortage that bodies should be set up to collect and assess data on manpower and shortages and make predictions about future needs. The Working Group recommended that industrial establishments also should be required to maintain sound personnel records and should assess their

manpower requirements on a regular basis. One step taken was the setting up in 1985 of 17 centres for storing, updating, retrieving and analysing manpower information to assist in planning technical education. This system, which is expected to expand, is being co-ordinated by the Technical Education Division of the Department of Education with the assistance of the Institute of Applied Manpower Research.

Another deficiency is that training in management skills has not received much attention. Several universities provide graduates in business management and the Ministry of Labour proposes to set up a National Entrepreneurship Training Scheme for craftsmen and apprentices. But there is a need for more training in management skills, risk-taking, design and production techniques.

Furthermore, there is a brain-drain of technical manpower. It is believed that many ITI-qualified persons migrate abroad. This is noticeable particularly in the computer sciences, bio-technology, nuclear and space science, plasma physics, etc. An article in The Statesman in January 1986 reported that two-thirds of the 800 engineering and science students who graduate from the Indian Institute of Technology in New Delhi go abroad, while the remainder change their professions for jobs where pay or prestige is higher. Since the Government spends 200,000 rupees on each engineering graduate and provides stipends and lodging, the loss to the exchequer was estimated at 200 million rupees a year in the case of the one ITI alone.

A further disturbing phenomenon is the under-use and seepage of skills. A 1979 survey in the eastern region revealed that 70% of engineering graduates employed in industry were working on routine and repetitive tasks; only 2.5% were engaged in research and development. This induces people of talent to search for jobs abroad. The survey also showed that 40% of jobs which should have been held by qualified diploma holders were done by skilled workmen -- either because of the shortage of these or because employers prefer to pay less to less qualified persons.

TRAINING IMPLICATIONS OF TECHNOLOGICAL CHANGE IN MANUFACTURING IN NEW INDUSTRIAL COUNTRIES: THE INDIA CASE

PART 2

CASE STUDIES

EXPLANATORY NOTE

The case studies discussed in this part of the report relate to the following manufacturing firms:

(1) General Electronics Limited, Sahibabad
(2) Eicher Goodearth Limited, Faridabad, Haryana
(3) National Fertilisers Limited, New Delhi
(4) Heavy Electrical Equipment Plant, Bhel, Haradwar
(5) National Thermal Power Corporation, New Delhi
(6) Escorts Limited, Faridabad, Haryana

The information that follows is based on replies to a questionnaire prepared from guidelines provided by the International Labour Office. A copy of the questionnaire appears at the end of this report. In most cases, personal discussions also were held with senior executives to supplement the written replies. However, the information is incomplete in some cases and may not be entirely up to date.

CENTRAL ELECTRONICS LIMITED SAHIBABAD

Profile

Central Electronics Limited was established in 1974 as a public sector undertaking. It manufactures electronic components and systems including technology and processes developed in various national laboratories. It employs 758 persons.

In the last five years, the value of the firm's annual output has more than tripled while sales have gone up more than 2.5 times. The firm does not export any of its products.

Technological changes/Innovations

The most important innovations in recent years have been:

Process innovations:

a) Silver paste for solar cell production as a substitute for imports;

b) Process improvement in the production of solar cells and solar modules;

c) Professional ferrite;

d) Microwave ferrite for phase shifters; and

e) High purity alumina bearings for heavy water project (Bhabha atomic research centre).

Product innovations:

a) Development of single and multi entry/exit axle counters for railway signalling;

b) Micro processor based automatic telephone exchange; and

c) Indigenous colour television based on CEERI Pilani know-how.

Technological backup has been provided through collaboration with foreign firms. For instance, there was collaboration with ITT in West Germany for production of colour TV; supply of a semi-automatic production line for solar cells and solar modules plus training of manpower by TPK, Canada; and collaboration with Westinghouse for a solar programme.

Government support for the introduction of new technology has been provided by a relaxation of excise duty, by subsidies and by funding of projects sponsored by the Instrument Development Programme of the Department of Science and Technology, the Department of Electronics, etc. The direct import of solar photovoltaic modules is normally subject to import duty of 175%, but the import of raw materials for the construction of solar cells is allowed free. There has been collaboration with various research institutions by development projects funded by the Department of Science and Technology.

Government support has had considerable impact. A highly qualified group of R & D scientists and engineers has been formed. A number of completely indigenous processes have been developed and produced, such as solar photovoltaic systems; electronic components such as ferrite cores; alumina ceramic; micro phase shifters; lasers; photon counter signal averagers; and other high technology instruments.

Identification and commercialisation of company products is carried out by marketing teams. Customer needs -- such as those for the national railways and defence -- are established in consultation with the appropriate agencies. The products then are developed through in-house R & D and in collaboration with research institutions.

The company's share of the market for various products is estimated as follows:

- Ferrite cores: 50% of national demand for professional ferrites;
- PZT and alumina ceramic: 80-90%;
- Railways: 50% of non-maintenance equipment and 15-20% for low-value items; and
- Solar photovoltaic systems: about 50%.

Introduction of new technology has resulted in increasing use of existing in-house scientific and technological capabilities, while collaboration with outside firms and research institutions is leading to skill enhancement for personnel in solar photovoltaic and projection TV production.

Manpower profile and policies

In the five years 1980-1984 the number of professional executive managers at Central Electronics Limited went up from 95 to 138, technical executives and skilled workers rose from 463 to 570 while semi-skilled and unskilled workers declined from 89 to 50. Professionals and technical executives were 14% of the total workforce while skilled workers accounted for 53% of the firm's 758 employees.

Almost all technical executives had professional university degrees while 82% of skilled (technical) workers had matriculated or had higher secondary qualifications.

The ratio of skilled persons to total workforce was 93% while R & D staff made up 18%. On the whole, the company has experienced little difficulty in recruiting manpower. But there is difficulty in recruiting some categories such as technocrats with micro-processing background and engineering graduates with experience in electronics, optics, lasers, etc.

Manpower turnover was 3.92% in 1982-83; 1.5% in 1983-84 and 2.35% in 1984-85. Redundant workers are retrained and absorbed in other work within the company, including new production projects. The main reasons for staff departures have been housing and inadequate transport, the company being somewhat isolated. There is flexibility in work organisation with executives being assigned multiple tasks after training.

Training policies and practices

Present company policy calls for on-the-job training for employees. Further development of in-house training is under consideration. Wherever training is necessary for new or modified skills, the assistance of foreign companies is sought for selected employees in small groups. There is very limited external recruitment from other firms.

A new training programme, drawn up in collaboration with staff and workers, calls for a list of 67 technical, engineering and management subjects. These have been divided into 10 modules of decreasing priority. The subjects in the first two modules are being conducted in-house in 1985-86. The plan proposes that supervisory staff will receive a one-week supervisory development course, coupled with technique improvement courses. Seven in-house two-to-four-day programmes covering productivity improvement and quality enhancement are being held for 30 workmen at a time. This training is carried out with the helpof the National Productivity Council. Staff engaged in purchasing, market research and costing attend courses arranged by Government agencies.

There are collaboration agreements for training with the National Productivity Council, the Delhi Productivity Council and with foreign suppliers. In 1985 the company drew up an outline of the topics and areas where personnel need outside additional training but as yet no regular curricula have been established.

Some 140 members of the staff are engaged in R & D: 13 managers, 26 supervisors and 101 others. Research mainly covers projects for an instruments development, magnotron tubes, solar photovoltaic energy, phase shifters and microwave ovens. There is Government support for the R & D since company personnel are engaged in research projects involving India and other countries.

The company experiences some difficulty retaining its trained staff. It attempts to solve this by bonding employees sent abroad for training, and by providing better motivation and challenges for its staff.

Apprentices receive training under the Government's Apprenticeship Training programme.

Skill diffusion

The company allocates some sub-contracts and so the following linkages take place with suppliers:

- Supply of drawings and discussions with technical staff;
- Imparting to sub-contractors knowledge of the product for which they are preparing components; and
- Personnel of sub-contracting firms receive training at Central Electronics Limited.

Workers' representatives take part in various decisions. Shop level, plant and joint level committees have been formed. Monthly reviews of production are held at shopfloor level and the views of staff are encouraged to improve productivity and staff welfare. An Industrial Relations Committee functions at corporate level, meeting every fortnight to create the atmosphere for ensuring production targets and improving working conditions.

EICHER GOODEARTH LIMITED
FARIDABAD, HARYANA

Profile

Eicher Goodearth Limited, a private company, started operations in 1963, manufacturing tractors in collaboration with Gebr. Eicher of West Germany. After initial setbacks, low production and financial losses for about a decade, the company turned the corner in 1970-71 and made a profit for the first time. This was made possible by a series of measures to develop some of the major components it required. Existing machine tools were modified, new production processes were worked out and equipment was developed to substitute for imports. Since 1970-71, the company's story has been one of success and diversification. Production of tractors increased from 100 a month in 1974-75 to more than 1,000 a month in 1979-80 and reached 1,500 in 1983.

In 1976 a second operation with two plants was set up in another state to manufacture low-cost, easy-to-maintain diesel engines and within a short time this was producing 1,000 engines a month. Two more plants were soon added in another state for the manufacture of transmission parts. Yet another unit was established in 1979 to produce machine tools to fill the company's growing needs. In 1981 another plant to make tractors was opened and finally a further unit was established in 1984 to make light commercial vehicles in collaboration with Mitsubishi Motors of Japan. The company entered the export market in 1976 and in 1981-82 it was awarded a certificate for commendable performance by the Engineering Exports Promotion Council.

Company turnover increased 20-fold within a decade. It went from 38 million rupees in 1974-75 to 810 million rupees in 1984-85. Company policy calls for low production costs, diversification, dispersal of activities, setting up plants in backward regions, a strong R & D effort, constant modernisation and renewal of equipment, and a host of training programmes for its manpower.

Besides its manufacturing units, Eicher Goodearth has five service divisions: 1) A research and development centre which designs modifications and improvements for existing products and introduces new products, 2) a marketing division which has a dealer network with a strong service base, 3) an exports division, 4) a corporate materials division to purchase components, capital items and proprietory items, and 5) a corporate office which provides services.

Technical changes/innovations

In the manufacture of machine tools, some process innovation has been carried out. Three-horsepower tractors have been introduced and three new models of 24-horsepower tractors have been developed.

Collaboration with the West German company ended in 1976. Recently there has been co-operation with Mitsubishi Motors. In both cases, Eicher Goodearth had access to their technological information. Design agreements were reached with the foreign firms and the company has also contacted some research institutions for assistance in design.

The Government supports innovations in the form of fiscal measures. It allows 100% depreciation on investments in R & D and there is 100% tax relief on R & D expenditures. Financial concessions and infrastructural support from state governments has been received for the setting up of plants in backward regions. The Government's fiscal incentives have had a favourable impact on R & D and hence on innovations, but the company feels that a recent liberalisation of import regulations can have an adverse effect on the development of indigenous technology.

The company conducts periodic surveys of the market to determine the need for new products. It has five new products on the market, two of which have been very successful.

New technology at the plant has meant some enhancement of the skills of its personnel, particularly in designing.

Manpower profile and policies

The company employed about 3,300 people in 1983-84, of whom 300 were executives with an average age of 32. Some 39% of these were engineering graduates, 10% were postgraduates, 14% held MBAs or were chartered accountants, 12% had engineering or business degrees and 25% had other qualifications. In one company unit, 37% of the workers were skilled, 33% were semi-skilled and 30% were unskilled. Some difficulties are experienced in recruiting senior personnel, particularly designers and quality control experts, but otherwise the company has little difficulty in getting the people it needs. There has been hardly any turnover among workers but 15% of the executive staff left between 1983 and 1985, largely attracted to India's expanding automobile industry.

As a policy, the company is against redundancy of its workers. When that is necessary, attempts are made to redeploy personnel to other units after training. A recent example was the redeployment of surplus staff to a newly opened unit for light commercial vehicles.

There is considerable flexibility in work organisation in both the manufacturing and service divisions. This is particularly true among executives, there being nine steps from lowest level to General Manager. Executives move rather rapidly from one position to another according to their performance. The executive staff -- particularly those engaged in marketing -- are essential for company success.

Training policies and practices

There are five types of training at Eicher Goodearth:

1) Executive Training Scheme:

Under this programme, which also provides pre-service training, freshly qualified engineering graduates and postgraduates are taken in as trainees. These are recruited mainly at the Indian institutes of technology, universities and regional engineering colleges. Training is for one year and comprises four modules. For the first nine months, trainees are exposed to technical production, industrial engineering, quality control, techno-commercial projects, marketing, materials, design, etc. The training draws heavily on project-based assignments together with classroom input. At the end of the nine months, the trainees are assigned to specific functions ranging from R & D to marketing, manufacturing, etc. There is a detailed appraisal system. On successful conclusion of their training, trainees are assigned to specific jobs at senior officer level. During training, engineering graduates receive 1,400 rupees a month and postgraduates 1,500 rupees a month, together with free accommodation or a housing allowance.

(2) In-house training programme

There are various skill-building workshops with a duration of a week or so where various subjects and problems are discussed. The senior staff also takes part in residential training programmes, focussing on behavioural skills, technical seminars and workshops.

(3) External training programmes

Some employees are sent to technical institutions for refresher or new training for varying periods.

(4) Seminars and conferences

The staff is allowed to attend external seminars and conferences and is encouraged to write papers for these seminars.

(5) Trade Apprenticeship training

Under the Government's Apprenticeship Training Scheme, the company takes trade and diploma apprentices and trains them in

different trades. A stipend is paid to each apprentice and the cost of the training is shared equally between the company and the Government.

The requirements for new or modified skills, when new production processes or techniques are introduced, are met through short one- or two-day training sessions. When new technology or a new product is introduced, maintenance service mechanics receive an intensive course of training. There are training courses for these workers conducted by the new equipment suppliers. The company insists that manufacturers or suppliers furnishing new equipment or systems should train company manpower either inside the country or abroad. Eicher Goodearth realises that, ideally speaking, training for new processes should be given prior to their introduction but the company is not yet geared to anticipating or providing training for such new skills.

Most of the company's needs for skilled manpower are met through "first job" recruitment at universities and colleges. Some manpower does come from other firms, but it is negligible.

So far there are no collective bargaining agreements covering training of company personnel. Most recruits at staff level are new graduates. Skilled worker recruits come mostly from the Industrial Training Institutes. Some sandwich-type training programmes are conducted for specific cases like safety. There are no structured training manuals. The curricula for modular training courses are adjusted to need, combining lectures with practical exercises, films and discussions.

The company works with various education and training institutions -- the Indian institutes of technology, industrial training institutes, management institutes, the National Productivity Council, etc -- in selecting as well as developing its staff. The Director of the company's R & D division is a member of the courses' committee of the Delhi Institute of Technology.

Training priorities are identified through an annual survey of training needs, programme appraisal data, discussions with line managers and executive staff, and with new departments that require training programmes.

The entire cost of training executive staff is borne by the company. The company sometimes offers a subsidy to those persons undertaking their own training.

Direct Government financial support to company training comes mainly in sharing the cost of training trade apprentices. When outside training institutions provide training that cannot be provided in-house, the company pays the costs. However, Government impact on skill development is considerable since it encourages R & D through tax

and capital investment concessions and it subsidises the education of all graduate and diploma engineers as well as trade apprentices employed by the company. The company feels that there should be more co-operation between industry and training institutions.

The company faces problems in retaining the manpower it has trained. It is said that the retention rate is only 30 to 40%. Its training system is considered very good by other firms and its trainees are lured away. The company therefore plans to convert its inter-modular training system into an in-service training programme. It proposes to put new recruits to work straightaway and then, after a year or two, to pull them out periodically for training by senior staff for a week or so. It is hoped this will help the company retain its staff.

In the field of R & D, the company has 45 qualified executives, 125 staff and 75 workers working in its R & D division. Current investment in the R & D centre is 60 million rupees with an annual budget of 10 million rupees. Specialists are developing new products and processes and improving existing ones. The main research emphasis is on diesel engines, transmission systems, hydraulic systems, trucks, tractors, electrical generators, etc.

Skill diffusion

There is linkage with suppliers for training. In many cases, suppliers provide training and the cost is either shared or borne completely by them. Suppliers conduct seminars on company premises. Subcontracting of R & D work is allocated to other research institutions or individuals on a project basis.

The company usually concludes a three-year package agreement with the unions after negotiating on matters affecting output, wages, etc. But there is little participation by the unions in matters concerning employment, research or training.

NATIONAL FERTILISERS LIMITED
NEW DELHI

Profile

National Fertilisers Limited, a public sector undertaking, was formed in 1974 to produce fertilisers. It has three operations in the states of Punjab and Haryana which were commissioned in 1978. They employ the latest technology for ammonia production by partial oxidation of heavy petroleum stocks. They have sophisticated instrumentation and nearly total automation and process control, as well as using the latest anti-pollution technology. The company set up in 1987 the first inland gas-based project which will produce 0.7 million metric tons of urea a year beginning in 1987. National Fertilisers also produces methanol, nitric acid, liquid and gaseous oxygen, nitrogen carbondioxide, sulphur, liquid fertilisers and heavy water. Nitrogen production was 501,000 metric tons in 1984-85.

The authorised and paid-up capital of the company is 4,000 million and 2,743 million rupees respectively. Sales went up from 1,344 million rupees in 1979-80 to 4,200 million rupees in 1983-84. Operating profits increased from 383 million rupees in 1981-82 to 418 million rupees in 1984-85. The company employs about 6,000 persons.

Technological changes/innovations

While there has been no process innovation, in-house research has led to innovations in development of liquid fertiliser. Technological backup for expansion of one company unit was provided by agreements with West German and Italian firms, and with the Government's agency for research and development, Projects and Development India, Ltd (PDIL). In the case of the other two units, engineering contractors were a Japanese firm and Engineers India Ltd, with licensing arrangements with Shell, Lurgi, Topsol, TEC, Mitushi Totsoe and Technimont.

The Government assists the introduction of new technology by providing financial support and gives assistance in making agreements with foreign companies for licensing, technical support, design and construction. PDIL supports the company's R & D. The company has a small research organisation for sorting out day-to-day problems. Being a Government concern, its technical development programmes are approved and supported by the Government. The introduction of new technology has enhanced the skill of its personnel. The company's share of the market for nitrogenous fertilisers is about 15%.

Manpower profile and policies

Company employment tables show that the number of professionals and executives increased from 7% to 7.6% in the period 1980-1984. In

the same time, the number of skilled workers declined from 65% to 58%. Supervisory staff comprised 13.3% of total employees in 1980 and 14% in 1984. Total company employment went up 17.3% from 4,913 in 1980 to 5,767 in 1984.

The company is organised in three levels: headquarters, production units and marketing. Headquarters has overall responsibility for finance, public relations, administration, R & D, industrial engineering and manpower information service, captive power, development of products, etc. The production units are responsible for production, maintenance, technical service and training, finance and vigilance. Marketing has central as well as area managers, conducts marketing research, etc. The research staff is small, about 10 persons, because all regular and major research is entrusted to the Government's central research organisation known as PDIL.

No difficulties are experienced in recruiting personnel. Turnover at managerial and technical levels is around 2% but the company fears this may rise because of the expansion of the fertiliser industry. There has been no redundancy as the company is young. There is some flexibility in work organisation, although specialists in production maintenance, in laboratories, finance and marketing usually remain in their jobs. There is some rotation at higher levels.

As markets are very competitive, field sales and marketing staff are considered most important for company success. The marketing division is considered vital for developing strategies and plans.

Training policies and practices

Policy is to train staff both at their induction and during their careers. Each production unit has a fully equipped training centre with workshops, lecture rooms, libraries, audiovisual equipment and faculty in both technical and management sciences. The courses last one and a half years for semi-managerial cadres, one year for technicians and two to four years for trade apprentices. This training is for fresh recruits who received stipends during their period of training. The following one and a half year training programme for junior executives demonstrates the thoroughness of the plan:

Induction to company products, regulations, marketing and production processes	2	weeks
Familiarisation with the plants, administration, finance, materials, safety, personnel, computers	4	weeks
Rotation to the three plants for a general insight	16	weeks
Familiarisation with computer programming	2	weeks

Institutional training at the Nangal Training Institute for general concepts on functioning of plants	3	weeks
Intensive in-plant training at work sites	24	weeks
Visits to other company units	1	week
Management training in supervisory skills	2	weeks
Intensive in-plant training (second stage) in units where they are to be finally assigned	22	weeks
Specialised training in consultation with ITIs and management institutes	2	weeks

Recruits in managerial cadres are required to be graduates in engineering science, Masters of Business Administration or Masters of Science in agriculture and the average age is 25 years. Technicians require a diploma or B.Sc. and should be about 25. Trade apprentices of 18 to 22 years of age require matriculation plus ITI training.

Since most new recruits come from educational or training institutions and are then given company instruction, very few employees are recruited from other firms.

The company collaborates with management training institutes, technical institutes, the Administrative Staff College and other schools for training its staff. Sometimes these institutions conduct programmes tailored to meet the company's needs. Training of personnel in new technology is also arranged through suppliers in India and abroad who arrange for courses.

Training priorities for staff who have shown ability are established by appraisal reports. So far the company has not had any problem in retaining its trained staff.

The entire cost of in-house training is borne by the company except in the case of trade apprentices where it is shared equally with the Government. There is no training grant as such from the Government but tax rebates are given for training expenditures involved with research activities.

There is no R & D department, although a small staff looks after day-to-day problems. Research projects sponsored with the Government agency PDIL involved financial allocations of 10 million rupees in the last five years. The main areas of research concerned pollution and environmental control, corrosion problems, cooling water treatment, use of waste products from fertiliser plants and quality control of fertilisers.

Skill diffusion

The company collaborates with other fertiliser producers through institutions such as the Fertiliser Association of India. It provides training for other firms and the company's employees also receive training with other firms and suppliers. For example, company employees have received training at Rashtriya Chemicals and Fertilisers in Bombay and in companies specialising in compressors, turbines and gasfire gun repairs.

HEAVY ELECTRICAL EQUIPMENT PLANT
BHEL, HARADWAR

Profile

The Heavy Electrical Equipment Plant, a public sector operation, was set up in 1963. Its main business is the engineering, manufacturing and supply of thermal sets in unit sizes of 200 and 1,000 megawatts, hydro sets, motors, control equipment and their spares. Secondary activities include: captive thermal power plants of 12 megawatt capacity for the supply of steam and electric power for industrial and domestic use; the production of producer gas, acetylene, oxygen, nitrogen and compressed air for industrial use within the plant, the manufacture of forgings, toolings and dies for use with the company's own products and the manufacture and supply of haulage winches.

The company had 10,760 employees in September 1985. Of these only 37 were temporary and two were casual. The organisational structure of the company is updated periodically in line with corporate objectives. At Haradwar, there are two plants, the Heavy Electrical Equipment Plant (HEEP) and the Central Foundry Forge Plant (CFFP). Both are under a group general manager. Until 1984, HEEP was function-oriented. Since then, there has been a shift to a mixture of function-based and product-based orientation as follows:

A) Product-based orientation:
   1. Turbines division;
   2. Electrical machines division.

B) Function-based orientation:
   1. Commercial co-ordination;
   2. Quality management;
   3. Finance;

4. Administration;
5. Facilities and diversification;
6. Management services; and
7. Vigilance

The paid-up capital of the company is 4,570 million rupees. The value of sales rose from 16,681 million rupees to 24,196 million rupees between 1980-81 and 1984-1985. Exports however dropped from 2,109 million rupees to 1,517 million in the same five-year period, although they reached 3,545 million rupees in 1981-82.

Technological changes/innovations

The following important innovations have taken place in recent years:

Process innovations:

- Introduction of numerically controlled and computerised numerical control (CNC) machines in the manufacture of turbine generators and heat exchangers, including a modern blade manufacturing line;
- Overspeed balancing tunnel for balancing large turbine motors at 20% overspeed in the vacuum tunnel;
- Computer aided programming for CNC machines;
- Thread whirling process for threads;
- Mica-elastic insulation system for large capacity generators and motors;
- Establishing the new coreplate varnishing Stablit 40.

Product innovations:

- Introduction of modular concept in steam turbines;
- Introduction of new range of AC and DC motors based on Class F insulation and modular concept;
- Fitting an improved runner in running hydro sets, thus increasing output by 14 megawatt;
- New concept in erection of condensers at site;
- Modification of 200 megawatt USSR-designed generator to suit KWU turbine for reverse direction of rotation and higher expansion;
- Provision of interchangeability of runner and shaft for hydro sets;
- Improvement in fixing and winding and overhang in turbogenerator;
- Design of hydrogenerator rotors without central shaft;
- Development of test shaft slip rings for testing 500 megawatt brushless exciter and generator.

Technological backup has been provided through collaboration with foreign firms. HEEP was formed in 1962 when a technical collaboration agreement was signed with Prommashexport, Moscow, USSR, as a result of an Indo-Soviet technical co-operation agreement. This

agreement covered the preparation and furnishing of a detailed project for the establishment of HEEP. Various annexes to the agreement covered the assignment of Soviet specialists to train company engineers in the design and manufacture of thermal and hydro sets, motors and control equipment as well as the supply of machinery and equipment and the transfer of technology. In an effort to update its technology and attain a leading world position in the manufacture of power equipment, another agreement was signed with Kraftwerke Union, West Germany, for know-how on thermal sets of 200 MW and 1,000 MW. A similar agreement on motor know-how was signed with Siemens, West Germany. Training and backup is available from these suppliers when needed, although there is no other tieup with foreign research and development institutes.

Government support for the introduction of new technology in the company is available through fiscal incentives, such as tax relief and lower depreciation allowances. There is no subsidy or development assistance but import restrictions help the growth and use of indigenous technology. The Government helps R & D projects through the allocation of funds and by providing tax and depreciation allowance relief. Technological development in the company is in line with Government policy and is supported by the Government.

For identifying and commercialising new products and processes the company has established a "diversification division" which carries out market surveys, studies on the feasibility of new products and techno-economic studies. The company has introduced the following new products to the market during the last five years:

- Thermal sets of 500 megawatt capacity;
- AC and DC motors for power plants, industrial drives and mining equipment based on Siemens designs; and
- Haulage winches for export to the Soviet Union.

Most of the thermal sets, hydro sets, AC/DC motors, control panels, condensers and heat exchangers made in the last five years are of indigenous design or from the designs of collaborators. All the products have been successful on the market.

As of March 31, 1985, out of the nationwide installed capacity of 42,167 megawatts, HEEP equipment was responsible for 13,656 megawatts, or 32%. The company share is expected to grow in the future due to the present trend to increase unit sizes. The introduction of improved products has enhanced the know-how of the company and improved the skills of its operators, technicians and designers.

Manpower profile and policies

Staff statistics over the five years 1980-1984 show that professional, supervisory and skilled (technical) workers make up about 80% of the

total workforce. Technical skilled workers alone account for 60% of the total and virtually all of these have matriculated or have higher secondary educational qualifications. Total staff strength did not increase perceptibly in the five years but supervisory staff went up in that time from 11.5% to about 13%.

The ratio of research/skill intensive manpower to total manpower was 8,563 : 10,744 or four to five. The company is able to recruit the manpower it requires. However some categories such as nurses and para-medical staff, translators and cashiers, are not easily available in the local market. There is a very nominal turnover of manpower and no redundancies. Departures are due to resignations, death and retirement. Those who resigned numbered 28 in 1970 and 73 in 1984.

There is flexibility in work organisation. In supervisory and executive cadres, employees with technical background are deployed in non-technical areas such as personnel, welfare and material management. Redeployment of manpower is carried out from time to time throughout the company to meet technological requirements, except in areas where skill and specialisation are required. Well-qualified engineers with a sound knowledge of the products and who have an aptitude for marketing and sales play an important role in marketing the company's products.

Training policies and practices

The company's training policy is to acquaint its employees with the latest technology and management software and to ensure a steady supply of trained manpower. To design its training programmes, the company collaborates with specialists in the technology to be introduced.

It recruits its executives, supervisors and artisans fresh from educational institutions and only in exceptional cases are specialists recruited from other organisations and firms. New recruits are trained before being absorbed into the regular staff. Training is carried out by in-house courses, outside programmes in India and sometimes in training courses abroad. As a rule, training of personnel is taken care of by collaboration agreements. Engineers and executive trainees up to 25 years of age require graduate degrees, supervisory trainees up to 25 require engineering diplomas and artisans require certificates from ITIs.

No sandwich-type training is organized for company employees. The training curricula both in-house and in institutions include courses in the technical, skill, functional, general management and behavioural areas. Training priorities are based on an overall plan, on departmental needs and the needs of individuals. Except in the case of trainees where costs are shared with the Government, all training expenses are borne by the company.

The company collaborates with many universities and training institutes for the instruction of its staff. No direct support is received either from the Government or the training centres. However, the company uses the faculty of prominent training institutions on a payment basis. Under the Government's Apprenticeship Training Scheme, the company provides training to ITI pass-outs, diploma holders and engineering graduates. There are facilities for 13 trades for trade apprentices, five for diploma holders and six for graduate engineers. In 1985, there were more than 600 trainees under this scheme.

The company has no problem in retaining the manpower it has trained.

About 10% of engineer hours are used in R & D activities and R & D financial allocations have varied from a high of 29.7 million rupees in 1980-81 to 12.7 million rupees in 1983-84. In 1984-85 R & D expenditure was 21.7 million rupees. Research is mainly directed to company products.

Skill diffusion

The company sub-contracts work connected with turbines, motors and generators to the tune of about 70 million rupees a year. Wherever possible, the company provides technical assistance to the sub-contractors, including the dispatch of company engineers to sub-contractors' plants. Welders from sub-contractors also visit the Bhel plant for training.

Trade unions and workers representatives take a part in decision-making processes. Plant/shop councils, which are advisory and consultative, are involved in discussions relating to production, productivity, quality, reduction of costs, elimination of waste, safety and other issues. The interaction between management and workers is regarded as having led to improvements in the company's products and its production schedules.

NATIONAL THERMAL POWER CORPORATION
NEW DELHI

Profile

The National Thermal Power Corporation (NTPC), a public sector enterprise, was set up in 1975 for the development of thermal power projects. It constructs thermal power stations and generates and transmits thermal and super thermal power. The head office is in New Delhi but plants are scattered around the country. By 1983-84 the corporation's contribution to new thermal power capacity in the country was about 24%.

The company has a three-tier organisational structure: the field power stations, regional offices and the corporate centre. The executive director in each region is responsible for all aspects of power project construction, power generation and transmission in his area, while the corporate centre is responsible for formulating policy, co-ordination and monitoring of activities. The corporate centre issues guidelines in all areas of activity, such as engineering, contracting, planning, finances, personnel and industrial relations.

In 1985, the company employed about 16,000 people of whom 3,000 were executives.

The authorised capital of the company increased from 8,000 million rupees in 1980-81 to 40,000 million rupees in 1984-85. Power generation capacity increased from 200 megawatts in 1981-82 to 2,400 megawatts in 1984-85. Nearly 46% of the total investment of 76,643 million rupees in 1983-84 was financed by the Government. The remainder was provided through international assistance, 34.5% coming from the World Bank. The value of sales was about 3,225 million rupees in 1984-85 compared to 1,386 million in 1983-84.

Technological changes/innovations

A significant innovation is the recent introduction of High Voltage Direct Current (HDVC) technology for the transmission of 1,000 megawatts straight from the Rihand power station to New Delhi. A major breakthrough in power system development is the introduction of HVDC to regional interconnections and long distance bulk transmission. Since NTPC did not have this technology, assistance was obtained from Hydro-Quebec International of Canada who identified the local requirements and developed the specifications together with NTPC engineers. There was also collaboration with ASEA of Sweden for the first 500 megawatt HVDC back-to-back station at Vindhyachal for interconnection between the Northern and Western Regions.

The company objective of complete self-reliance has now been achieved to a large extent although there is continuing contact with foreign consultants. The introduction of the new technology and collaboration with foreign firms has enhanced the skills and technical capabilities of the company's technical staff.

Since the company is a public sector undertaking it receives all possible support from the Government in developing its activities, innovations and improvements in technology. The expense of R & D is exempted from tax and depreciation on capital investment is 100%. Since there is a considerable shortage of power in the country there is no difficulty in selling the company's product. Its performance has been good and in 1984 the company received an award under the Meritorious Productivity Award Scheme.

Manpower profile and policies

A detailed breakdown of manpower qualifications and skill categories was not made available. One-fifth of the total number of employees are executives and one-third of the executives are highly qualified professionals receiving salaries of 3,000 rupees a month or more and most of these are in their thirties. The company finds no difficulty in recruiting the staff it needs. There is no redundancy as the company is expanding. Its total number of employees is expected to go up to 46,000 by the year 2,000, compared to 16,000 now.

Training policies and practices

The company has one of the most elaborate and comprehensive training schemes in the country. It places a high premium on developing its staff, re-orienting their skills and attitudes and "nurturing a culture for the realisation of the challenging tasks ahead", as a training publication puts it.

The company estimates it will need 5,850 executives, 4,350 supervisory personnel and 21,100 non-supervisory staff by the year 1989-90 to manage stations and projects with an estimated generating capacity of 8,980 megawatts. It will need 18,700 specially trained and skilled personnel for operation and maintenance of the stations and transmission systems.

The company's training strategy has two main directions: pre-employment schemes and post-employment schemes.

Pre-employment training aims at providing requisite skills to fresh trainees at different induction levels. The various pre-employment programmes are for:

1) Engineering executive trainees -- a one-year course to orient young engineers to high technology;

2) Finance and personnel executive trainees -- a two-year course including on-the-job and rotational training;
3) Executive trainees (chemistry) -- a one-year course for postgraduates;
4) Diploma trainees -- a one-year course at various project sites
5) Personnel supervisor and accountant trainees -- a one-year course of comprehensive training;
6) ITI trainees -- a one-year job-oriented course for certificate holders to develop skills as operators and maintenance technicians.

These training schemes for fresh graduates are said to have had a tremendous response with as many as 35,000 applications received in the year 1983-1984. Graduates recruited under these schemes now make up almost 40% of the total executive strength of the company.

Post-employment training schemes cover programmes for management and other employees. At management level, in-house tuition takes place at the company's Centre for Education in Power Management, which has become an important institution collaborating with the Economic Development Institute of the World Bank for organising national and regional programmes on power planning, etc. Short and long-term employment development programmes for other staff are designed to introduce new technology and give personnel an opportunity to obtain higher education and upgrade their skills.

Specialised training activities include orientation to 200 and 500 megawatt operations, including in-house study and visits to manufacturers' plants; training by suppliers under contractual arrangements with them; training in preparation for eventually switching 15% to 20% of company personnel over to maintenance as new units come into operation; training at a 200 MW simulator where personnel can be acquainted with all aspects of operations without being dependent on a running plant; and advanced training abroad to expose experienced engineers to new developments in engineering and management.

Besides the company's Centre for Education in Power Management, it has a Central Training Institute at the Badarpur thermal power station complex which identifies training needs and conducts training programmes. This is being built into a self-contained unit with laboratories and workshops and hostel facilities for trainees. There are also training centres at project sites for providing formal and on-the-job training to executive, diploma and ITI trainees. They are equipped with hostel facilities, auditoria and workshops and specialise in long- and short-duration training programmes.

Collaboration with educational and training institutions include arrangements with:

- ITIs for specialised technical modules;
- The Power Engineering Training Society (PETS) for engineering trainees as well as to provide specialised training for ITI and diploma trainees;
- The Power System Training Institute (PSTI), Bangalore, for transmission trainees; and
- CFRI, Dhanbad, and other chemical research laboratories for chemistry trainees.

These institutions carry out training based on company specifications after the curricula have been worked out by line personnel and the training departments. Individual trainees have no expense. The company bears the costs and pays the institutions at rates set for central public sector undertakings.

A R & D development centre has been established with 20 scientists and engineers with allocations of 20 million rupees for capital investment and 40 million for running expenses over a period of five years. The main areas of research are:

- The study of long-standing problems;
- Introduction of new technology to increase efficiency of power plants and improve power generation and tranmission;
- Providing feedback to equipment manufacturers to improve their reliability; and
- Environmental pollution control and use of plant by-products.

The company does not get direct training grants or reimbursement of training expenses but it pays subsidised rates for using Government training institutions. There is also Government support for training in foreign countries under bilateral agreements and through Government agencies like PETS. New recruits undergoing training sign three-year bonds with the company, while staff going abroad for training sign bonds of one to four years.

Skill diffusion

Supplying firms take part in training workshops organised by the company, while company personnel also are trained by suppliers. The company regards this as imperative "with NTPC going in for global tendering to establish modern power stations".

There are agreements with the union covering wages and benefits. In keeping with Government policy, worker participation has been introduced at the Korba and Badarpur stations. It is expected that the involvement of employees in various plant councils at project level will enhance the commitment of the staff to the growth of the company.

ESCORTS LIMITED
FARIDABAD, HARYANA

Profile

Escorts Limited, a private company, was established in 1944. Its products include automobile shock absorbers, industrial equipment, motor cycles, tractors, electronic parts and railway equipment. It has three subsidiaries: Escorts Transmissions Ltd., Escorts JCB Ltd., and Escorts Electronics Ltd. The authorised capital in 1983 was 200 million rupees and paid-up capital was 142 million rupees . In 1983, the company's turnover was 2,739 million rupees as against 2,232 million the previous year, a growth of about 23%. Pre-tax profit for the same years increased by nearly 49% from 119 million to 177 million rupees.

The following information is not complete and does not cover all company units. In the case of technological innovations and research and development, the information relates only to the centre producing agricultural tractors and industrial equipment.

Technological innovations/changes

Product innovations in agricultural tractors and industrial equipment include the development of two engines for new tractor models, mobile cranes, front-end loaders and a truck model crane.

Technological backup has been provided through collaboration with various foreign firms. For instance, there has been co-operation with Ramson & Rapiers of the United Kingdom and FAUN of West Germany for mobile cranes, Dynapack of Denmark for vibratory rollers, Konark & Bramsy of West Germany for railway couplers and brakes, Yamaha of Japan for motor cycles and Mercury for outboard engines.

Government support for the introduction of new technologies and innovations comes only indirectly through tax relief on investments and 100% depreciation on capital expenses for R & D. There are no direct subsidies. Government rules on imports of technology conform to overall policy and are not specifically related to the company's products. In its efforts to develop and adapt the new technology the company receives some support from research institutions with which it collaborates, such as the Indian Institutes of Technology, the Automotive Research Institute of India, the Indian Institute of Petroleum and the Indian Institute of Sciences at Bangalore.

The company's introduction of tractors and cranes to the market has been successful. Identification and commercialisation of new products is done largely through demonstrations. The introduction of new technology has meant skill enhancement for the personnel

concerned. For example, the introduction of computer-aided design has added to the skill of engineers.

Manpower profile and policies

During the five-year period between 1980 and 1984, total employment at Escorts Limited went up 40% from 2,830 to 3,975. Professional and executive staff rose by 68% from 252 to 425 while supervisors increased 35% from 578 to 785. Technically skilled employees rose dramatically from 800 to 1750., while non-technical skilled workers declined 43%. Thus there has been a considerable upgrading of skilled labour in the past five years.

Most technical professional, executive and supervisory staff had degrees and diplomas from universities and technical colleges. Of the technical skilled workers as many as 91% had diploma-level qualifications. There were about 300 apprentices at various levels and about 50% of these were semi-skilled.

The company has had no difficulty in recruiting manpower. Turnover is low among managers and skilled workers, but is rather high in the case of professional engineers, MBAs, etc in the first stages after recruitment due to higher salaries and benefits being offered by similar establishments in the area. There is no bonding of trainees and employees. There also is no problem of redundancy as the company continues to expand. Those whose jobs are terminated by introduction of new techniques are retrained and reassigned.

There is flexibility in work organisation and staff are moved between departments as required. Field personnel are considered an important factor in market competition.

Training policies and practices

There are training arrangements at all levels but mostly for managers and officers. Training for new skills resulting from the introduction of new processes are met mainly though arrangements with the suppliers providing the new equipment. All other skilled manpower needs are met through "first job" recruitment from educational and training institutions with little external recruitment from other firms. There are no sandwich-type training courses and the firm does not collaborate much with educational or training institutions for staff instruction. There is little support from the Government except under the Government's Apprenticeship Training Scheme and the pre-employment training received by some new company recruits at Government-run ITIs.

There are three research centres: one for agricultural tractors and industrial equipment, a second for Ford tractors and the third for motorcycles. Government support for R & D comes only from tax and depreciation reliefs.

Skill diffusion

Sub-contracts are concluded for 40% of the components for tractors and, where necessary, the company provides suppliers with technical assistance, designs and other know-how. If so desired, it also trains the staff of supplying firms.

There is collaboration with the union regarding wages and salaries but the union is not consulted concerning employment and training.

TEST OF HYPOTHESES

The ILO study poses certain hypotheses *(in italics below)* to be tested. While it is not possible to generalise on the basis of only six firms which cannot represent the entire Indian manufacturing sector, it is possible to form an idea of the training implications of technological changes, particularly measures taken by the Government. With the caveat that no generalisations can be made regarding the manufacturing industry as a whole, brief responses to the hypotheses are:

There is Government support for technological change:

The Government has emphasised the development of science and technology in all its Five-Year Plans. The present Government is very keen on computerisation and the adoption of the latest technology. It is generally believed that India lags at least 10 years behind the industrialised Western countries and serious efforts must be made to catch up. The Technology Policy Statement in 1983 and the revised Computer Policy Statement of 1985 give an idea of measures taken by the Government to help industry import and adapt to new technology. Fiscal incentives in the form of tax relief and depreciation allowances assist R & D activities.

There is Government support for technical education and training:

As seen in Chapter III, Government efforts to promote technical education and vocational training are extensive. There is no lack of technical institutions nor, according to some observers, is there a shortage of engineers and diploma holders (technicians). Yet imbalances exist in the demand for and supply of technical manpower in emerging trades and unless steps are taken urgently to make the necessary adjustments in engineering institutions, the goal of rapid

computerisation and new technology in manufacturing is unlikely to be achieved. Vocational training needs to be of better quality and greater diversification. Both industry and Government recognise the need to develop and augment the supply of trained manpower. While the Government bears the entire cost of technical education and vocational training, industry also has risen to the need with more than 600 in-house training and research arrangements, such as those outlined in the case studies. Perhaps the single most important measure undertaken by the Government to increase the pool of trained manpower is the Apprenticeship Scheme.

Manpower is available:

All the firms which responded to the questionnaire reported no difficulty in recruiting the manpower they need, except for some highly skilled categories not yet provided by the educational system. There has been little advance planning for the new technology. But, with the speed that Government and industry have acted to identify and meet critical shortage areas, it could be that most imbalances will be eliminated in a few years' time. One serious lack is the absence of information on manpower shortages. Some rudimentary efforts have been made to estimate the shortages existing among professionals and technicians but inadequate efforts have been made to determine the efficacy of training for skilled workers and artisans. One result has been the production of artisans in Industrial Training Institutes who merely swell the live registers of employment exchanges. The Seventh Five-Year Plan stresses the need for a system to ensure that training meets actual needs.

One point made by a senior company executive was that private firms have little chance to send their technical experts abroad for training under Government scholarships and facilities, as these opportunities are generally monopolised by Government officials.

There has been technological change in the firms:

All the firms reported that they had carried out technological changes, but they did not indicate how original these were. One thing is clear: there is an awareness of the need for innovation. There are R & D efforts in individual establishments but these appear to be still in their infancy with the number of staff allocated to R & D very small.

The firms are affiliated with foreign companies and collaborate with R & D institutions:

All the firms studied co-operated with foreign companies in varying degrees for securing equipment and know-how. Collaboration with R & D institutes included sending company staff to suppliers for training, attending seminars and conferences, inviting R & D institute staff to give talks and membership by senior executives in academic

organisations. The introduction of new technologies and the training of staff abroad has enhanced the skills of technical manpower.

The firms act as diffusers of skills:

While some companies reported diffusion of skills through sub-contracting work and training the staff of contractors, the link does not seem very strong or frequent. Some diffusion also takes place through providing designs and specifications to sub-contractors but this could be intensified.

There are independent unions and collective agreements for wages, working conditions, etc, in all firms studied but the unions are not generally associated with recruitment or training policies.

CONCLUSIONS

There is no doubt that there is an awareness at all levels of the importance of trained skilled manpower to meet technological changes as well as an understanding that these changes have far-reaching implications for training. However, there have been delays in reaching this conclusion and by and large there remains a lack of speed and urgency.

The technical education network is extensive but adjustments need to be made to meet critical shortages in some areas of technology. It is imperative that the quality of training, particularly at the technician and vocational level, be improved. Industry has become aware of the requirement but it clearly has to do more on its own rather than relying on Government training programmes.

Company expenditure on R & D and collaboration with R & D institutions is minimal. There is also a requirement for closer consultation and association with workers' representatives in matters concerning training and technological changes. A continuous assessment of existing training facilities is a further requirement to ensure that manpower imbalances do not thwart the changes necessary for India to catch up with the advanced industrialised countries.

TRAINING IMPLICATIONS OF TECHNOLOGICAL CHANGE IN MANUFACTURING IN NEW INDUSTRIAL COUNTRIES: THE INDIA CASE

ANNEX

QUESTIONNAIRE FOR ENTERPRISES

Section 1 - General

1. Name of firm

2. Address and telephone number

3. Nature of Business
   a) Main business
   b) Subsidiary activities, if any

4. Year when established

5. Total number of workforce:
   a) Permanent
   b) Temporary
   c) Casual

6. Organisational structure

7. Please provide for five years
   a) Paid-up capital
   b) Value of output
   c) Value of sales
   d) Value of exports
   e) Value added (i.e. sum of profits, dividends, wages and taxes)
   f) Volume and structure of investments

Section 2 - Technological changes/Innovations

1. Examples of most important recent innovations
   a) Process innovations
   b) Product innovations.

2. Source and content of technological backup, for example, licensing agreements or other co-operation with foreign firms and R & D institutions. How strong are affiliations or associations with foreign firms and research institutions for providing technological backup and training?

3. Describe by what measures the Government supports innovations and introduction of new technologies in your company, for example, by means of:

a) fiscal incentives, including tax relief, depreciation allowances etc

b) direct subsidies

c) product development assistance, etc

d) regulation of technology imports by means of, say, tariffs and licensing arrangements

e) promotion of the use of local technology suppliers

f) establishment and support of R & D institutions.

4. What is your assessment of the impact of the Government's support on technological development in your company?

5. Describe any mechanism that you may have to identify and commercialise new products and processes.

6. How many new or adapted products have you put out on the market during the past five years? Have the products been commercially successful?

7. Please describe the markets for your products, i.e. in terms of market share, etc.

8. Has the introduction of new technologies meant genuine skill enhancement of personnel? If so, please give some examples.

Section 3 - Manpower profile and policies

1. Figures for the past five years on employed staff at various educational, skill and functional levels in your company.

a) Please provide the following details in respect to employed staff for 1984-85: Total workers, numbers with informal training only; apprenticeship training only; diplomas; professional and technical degrees; below matriculation; matriculation level and higher secondary; degrees. Please distribute these educational qualifications according to the following categories of employees: a) Technical and non-technical professionals, executives, managers; technical and non-technical supervisory staff; technical and non-technical skilled workers; semi-skilled workers; unskilled workers.

b) Please provide the number of persons in the years 1980,1981,1982,1983 and 1984, male and female, in the following categories: a) technical and non-technical professionals, executives and managers; b) technical and non-technical supervisory staff; c) technical and non-technical skilled workers; semi-skilled workers; unskilled workers.

2. Please give organisational charts, manning tables or equivalent to show the organisation of work and, if possible, its evaluation over time.

3. What is the ratio of research and skill intensive manpower to the total workforce?

4. Can you easily recruit the manpower you need in the domestic labour market?

a) At what levels of skills and qualifications do you meet particular recruitment difficulties?

b) What is the turnover of your manpower at various skill levels?

c) If turnover is considerable, say greater than 5%, what do you attribute this to?

5. Does your company have an explicit policy regarding redundancies?

6. What are the major reasons for staff leaving your company?

a) Natural attrition, retirements, etc (numbers and percentages during the last five years)

b) Redundancies

c) Other reasons (specify).

7. If relevant, describe with the help of specific examples, how your manpower has been redeployed during the recent past.

8. What is the degree of flexibility in

a) Work organisation

b) Redeployment (including rotation, multiplication of tasks, etc) of manpower in the process of production and authority structure.

9. What categories of personnel are a determining factor for success in market competition?

Section 4- Training Policies and Practices

1. Please describe your firm's training policy.

2. Please describe how you plan training programmes to meet the requirements for new or modified skills when introducing new production techniques and processes.

3. What is the relative importance for meeting your needs of manpower and skills of:

a) External recruitment from other firms?

b) "First job" recruitment from education and training institutions?

c) Training given by engineering firms or manufacturers supplying new equipment and systems?

d) In-house training.

4. What is the role of collective bargaining and technology agreements in training company personnel?

5. Please give a detailed profile (in terms of age, education, training and work experience) of recruits.

6. Do you have sandwich-type training programmes (explain)? If yes, what is the duration and sequence of institutional and in-house, including on-the-job, training?

7. Describe briefly the duration, the training contents and curricula used for each training programme by modes of training (institutional, in-house, on-the-job)

8. Please describe your collaboration with educational and/or training institutions:
   a) Which institutions do you collaborate with?
   b) How are training priorities identified?
   c) How are training curricula designed?
   d) How are costs shared between your firm, collaborating institutions, and individual trainees?

9. Do you have any research and development programmes? If so, give
   a) Number of research staff engaged at various levels
   b) Financial allocations over a period of five years
   c) Main area of research.

10. Please describe how the Government or public training institutions support training efforts in your enterprise:
   a) Is it by providing grants?
   b) Is it by means of a training levy and reimbursement of training costs incurred?
   c) Is it by tax reductions on training costs incurred?
   d) is it by other means?

11. What is your assessment of the impact of Government support for skill development and training in your company?

12. Do you have a problem retaining the manpower who have been trained by your firm?
   a) If yes, please describe the scope of the problem
   b) How do you deal with this problem?

13. Please describe apprenticeship training schemes and arrangements , if any, in your firm.

Section 5- Skill diffusion

1. Please describe briefly the scope and content of sub-contracting and co-operation with other firms

a) What is the scope and content of linkage with supplying firms?

b) Do you receive or give training assistance from or to these firms?

c) If yes, please describe the training received from or given to these firms.

2. What is the degree of active participation of trade unions and workers' representatives in decision-making regarding employment and output?